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### AUTOMATED DECORING SYSTEM AND DECORING DEVICE

5 The invention relates to an automated decorating system of cores of cast of castings, and the decorating devices which comprise the decorating system.

10 A casting comprising hollow parts is usually moulded around a mix of sand and resin, called core of cast, of complementary shapes with that of the hollow parts. The cores of cast are then eliminated, particularly when the shape of the casting is complicated, by subjecting the latter to hammering so as to detach the cores of cast from the part, and then to vibrations so as to disintegrate the cores and evacuate the fragments via gravity.

15 It is known, from the patent application FR 2 711 931, a decorating device constituted of a frame linked to a support attached via four vertical cylindrical articulations, transversally distortable in an elastic manner, and positioned symmetrically in relation to the axis of symmetry of the frame, which corresponds to its centre of gravity. The frame is constituted of three horizontal symmetric plates linked together via two cores welded to the plates. Two unbalanced motors, with vertical axes of rotation, and assembled in the plane of symmetry of the three plates, on either side of the frame, allow  
20 to shake the castings to be decorated. The frame comprises two rectangular openings on either end of the frame. A pneumatic cylinder is located in each of these openings, so as to hold a part between the cylinder and one side of the opening, at each end of the chassis. The latter side of the opening is drilled to allow a pneumatic hammer to pass through which is used to  
25 hammer the part. The two cylinders are assembled opposite each other. An inconvenience of this decorating device is that it is space consuming. Due to this, its installing on an industrial site incurs major space constraints. Another inconvenience of this device is that it is heavy, hence equipped with large motors, which generates high manufacturing costs and high energy  
30 consumption. Moreover, this generates a relatively small amplitude of movement, therefore a lengthy disintegration of the core. A third inconvenience of this device is that access is via two locations positioned

opposite each other, which is impractical for the loading of parts. Moreover, the commissioning of the device can only take place once two parts are loaded and clamped, each in one of the openings in the frame, which makes the lapse time between the two cycles rather long.

5           The purpose of the invention is to overcome some of the inconveniences of the prior art by proposing an automated decorating system, characterised in that it comprises a plurality of decorating devices each comprising a frame in the form of a two pronged fork, the space between said prongs being intended to receive a part to be decorated, and, each of the  
10   aforementioned decorating devices is enclosed in a chamber having only one loading door, and in that the plurality of decorating devices is disposed within the operating radius of a loading robot which is provided to load the part to be decorated through a single face of the decorating device into the space provided for said purpose.

15           Another purpose of the invention is to propose a decorating device of the decorating system, characterised in that the frame has a single space allowing to receive a part to be decorated, this space being located at one of the ends of the frame, in that the frame is supported by four elastic suspension units with a substantially vertical axis and transversally  
20   distortable, each suspension unit being integral with a base, in that the frame is vibration driven by two unbalanced motors with a substantially vertical axis, each attached to one side of the frame in the vicinity of two of the elastic suspension units, and in that a device for tightening the part to be decorated is assembled on one of the prongs of the frame, said tightening device being  
25   constituted of a cylinder onto which is assembled a tightening plate, allowing to tighten the part to be decorated between the plate and the inner surface of the other prong, the other two elastic suspension units being positioned so that the centre of gravity of the loaded decorating device remains between the attachment points of the four suspension units, so that they substantially  
30   support the same mass.

According to another feature, the frame is substantially horizontal, the other two elastic suspension units being positioned in the vicinity of the space

between the two prongs of the frame and in that the motors revolve in the same direction, rotating the frame about the axis located at the intersection between the middle plane of the motors and the transversal plane of the frame.

5        According to another feature an opening is made in the prong of the frame that does not bear the cylinder, this opening receiving the end of at least one pneumatic hammer, attached to at least one upright integral with the base, which allows to hammer the part to be decored when the latter is clamped within the frame, so as to disintegrate the cores of cast.

10       According to another feature, the space between the prongs of the frame comprises a bottom with an opening, so as to facilitate both the tightening of the part to be decored and the evacuating of the sand from the frame.

15       According to another feature, the decoring device comprises two pairs of lateral springs with a substantially horizontal axis, integral with both the frame and an upright attached to the base, allowing to match the resonance of the frame.

20       According to another feature, the frame is constituted of a body and a head, the head comprising the two prongs of the frame and being integral with a rod passing through the body of the frame and being driven in rotation about the axis of the frame by a motor.

25       According to another feature, the frame is substantially vertical and the motors revolve in opposite directions, generating an alternative translation movement of the frame along the axis located at the intersection with the middle plane of the frame and the transversal plane of the motors passing through the centre of the motors.

30       According to another feature, the decoring device comprises at least a pair of pneumatic hammers, attached to at least one upright integral with the base, which allows to hammer the part to be decored on either side of the frame when the latter is clamped within the space between the two prongs of the frame, so as to disintegrate the cores of cast.

According to another feature, the tightening plate is fitted with an air propulsion system to help evacuate the sand from the part to be decored.

Other features and advantages of the invention will become clearer upon reading the description below, in reference to the annexed drawings, in which:

- drawing 1 represents a horizontal decorating device according to a first embodiment;
- drawing 2 represents a horizontal decorating device with lateral springs according to a second embodiment;
- 10 - drawing 3 represents a rotating horizontal decorating device according to a third embodiment;
- drawing 4 represents a vertical decorating device according to a fourth embodiment;
- drawing 5 represents a decorating system with several decorating  
15 devices.

The decorating device, according to the embodiment in drawing 1, comprises a substantially horizontal frame (1) in the shape of a two-pronged fork (11, 12). The frame (1) is supported by four elastic suspension units (2) with a substantially vertical axis, that can distort transversally, and laid out  
20 over a base (3) so that each of them substantially supports the same mass. The decorating device also comprises two unbalanced motors (4) attached to the frame, each on either side, behind the fork. The space (13) between the two prongs (11, 12) of the frame (1) allows to receive the part to be decored. It is held between the inner wall of one of the prongs (12) and a substantially  
25 vertical plate (not represented in drawing 1, but marked 6 in drawings 3 and 4), rendered integral, using rods (50), with a cylinder (5), for example pneumatic, assembled in the inner wall of the other prong (11). Said plate comprises, in an alternative embodiment (not represented), air propulsion devices to help evacuate the sand from the part to be decored. The space  
30 (13) between the prongs (11, 12) of the frame (1) comprises a bottom with an opening (135), which allows to facilitate both the inserting of the part to be

decorated and the evacuation of the sand from the frame (1). The wall of the prong (12) that does not bear the cylinder (5) has a substantially horizontal opening (125) through which the end of at least one pneumatic hammer (7) passes and is assembled onto an upright (8) attached to the base (3). In the case where the device comprises several hammers (7), the latter are positioned one above the other, perpendicular to the middle plane of the frame (1).

The unbalanced motors (4) of the decorating device according to the embodiment in figure 1 revolve in the same direction, when the device is in operating mode. The resulting movement of the frame (1) thus rotates the part about the vertical axis (z-z) located at the intersection of the plane (y-z) passing through the pair of motors (4) and the vertical plane (x-z) transversal to the frame (1). Subject to this movement, the part is thus, alternately, in contact with the hammers (7), and not in contact with the hammers, which allows a hammering of the part by the hammers (7). In an alternative embodiment, the hammering is performed prior to the commissioning of the motors.

The embodiment in drawing 2 is the same as that in drawing 1, with the addition of four lateral springs (9) of substantially horizontal axis which are attached in pairs on either side of the frame (1), transversal to the latter. One of their ends is attached to the prongs (11, 12) of the frame (1), and their other end to an upright (10) attached to the base (3). The pneumatic hammering hammers (7), as well as the plate (6) which is positioned on the end of the cylinder (5), despite not being represented in drawing 2, are part of the decorating device according to this embodiment. The springs (9) alter the resonance frequency of the frame (1) to bring it to the vibration frequency value of the motors (4). In this way, the vibration frequency of the frame is increased, for example by a factor 10, which allows, with a low excitation force, to obtain an acceptable amplitude value for decorating. The springs (9) thus allow to considerably reduce the power, the size and the weight of the unbalanced motors (4). The latter no longer need to produce the vibration force, but only the excitation of the device to its resonance frequency. A

speed regulator allows to adjust the excitation frequency to the exact frequency of the frame (1).

In the embodiment in drawing 3, the frame (1), in substantially horizontal fork shape, is in two parts: on one hand, the body (14) and, on the other hand, the head (15). The head (15) of the frame, constituted of two prongs (11, 12), is integral with a rod (16) passing through the body (14) of the frame (1), and parallel to the axis (x-x) of the frame (1). This rod (16), directed by a guide (17) on the inside of the frame (1), can turn about the axis (x-x) of the frame (1) thanks to a motor (18), to which it is connected, which is attached to the base (3). The body (14) is supported by the same four elastic suspension units (2) as in the embodiment in drawing 1, laid out so that each one substantially supports the same mass. The body (14) vibrates about the vertical axis (z-z) thanks to two unbalanced motors (4) revolving in the same direction, with a substantially vertical axis, and attached to the body (14) of the frame (1), each on either side of the frame (1). The head (15) of the frame (1) comprises, as in the embodiment in drawing 1, a cylinder (5), for example pneumatic, on which a plate (6) is positioned to hold the part to be decorated within the space (13) between the two prongs (11, 12). The decorating device also comprises at least a pneumatic hammer for hammering (not represented). In the embodiment of this device, the hammering is performed prior to the commissioning of the motors. This embodiment also allows for very good evacuation of the sand because the part can be rotated about 360°.

In the embodiment in drawing 4, the frame (1) is substantially vertical. As in the embodiment in drawing 1, it is supported by four elastic suspension units (2), with a vertical axis, attached to the base (3), these suspension units can distort transversally in an elastic manner. As in the other embodiments, they are laid out so that each one substantially supports the same mass. Two unbalanced motors (4) revolving in opposite directions are attached to the frame, each on either side of one of the prongs (11). The part to be decorated is to be tightened within the space (13) between the two prongs (11, 12) of the frame (1), using a cylinder (5), for example pneumatic, on which a plate

(6) is positioned, and which is assembled on the inner wall of one of the prongs (11). The resulting movement of the frame (1) thus generates an alternative translation movement of the part along the horizontal axis (x-x) located at the intersection with the middle plane (x-z) of the frame (1) and the transversal plane (x-y) of the motors (4) passing through the centre of the motors.

In this embodiment, the decorating device comprises at least two pneumatic hammers (7) attached in pairs onto the uprights themselves attached to the base (3). The end of the hammers (7) are no longer within the frame (1), as in the embodiment in drawing 1, but on either side of the prong (12) opposite the one to which the cylinder (5) is assembled. Thus, the hammering is performed on the sections of the part to be decorated which extend beyond either side of the frame (1). This embodiment is therefore particularly well suited to decorate large parts. In an alternative embodiment, the hammering is performed prior to the commissioning of the motors.

In all the aforementioned embodiments, the decorating device is enclosed in a soundproofed chamber (19) comprising an automatic or manual closing access (20) allowing to insert and tighten a part to be decorated in the decorating device. The inserting and removing can be done manually or using a robot (21).

In the case where access to the chamber of the decorating device is closed automatically, and where the inserting and removing are robotized, several decorating devices can be used simultaneously to decorate several parts at the same time, as represented in drawing 5. In this case, the decorating devices are positioned either parallel to each other along a straight line, the accesses thus all being located on the same side of the straight line, or on an arc of circle, the accesses thus all being oriented towards the centre of this arc of circle. The arc of circle alternative however allows to move quicker from one decorating device to another, thereby increasing the decorating performance.

Such a robotized method allows to simultaneously use different decorating devices according to the embodiments in drawings 1, 2, 3 and 4, or

any other type of device. If the decorating device according to the embodiment in drawing 3 is used within the context of a robotized method of this type the head (15) of the frame (1) must be in the horizontal position come the end of the decorating cycle.

5           In the case of a robotized method allowing to use several devices at the same time, the removing, the inserting and the decorating can be time-staggered on said devices.

          In all the aforementioned embodiments, the frame (1) is constituted of two parallel plates attached by cross members. Furthermore, the unbalanced  
10       motors (4) do not necessarily revolve synchronically upon commissioning, but synchronise after about a half revolution.

          It should be obvious, for those skilled in the art, that the invention allows for embodiments under numerous other specific forms whilst remaining within the field of application of the invention as claimed.  
15       Consequently, these embodiments should be considered as illustrations that can be adjusted within the field defined by the scope of the attached claims, and the invention should not be restricted to the details given above.

          Thus, other embodiments combining two or several of the aforementioned embodiments can be envisaged.